Putting a Price on Carbon Emissions

EES 3310/5310

Global Climate Change

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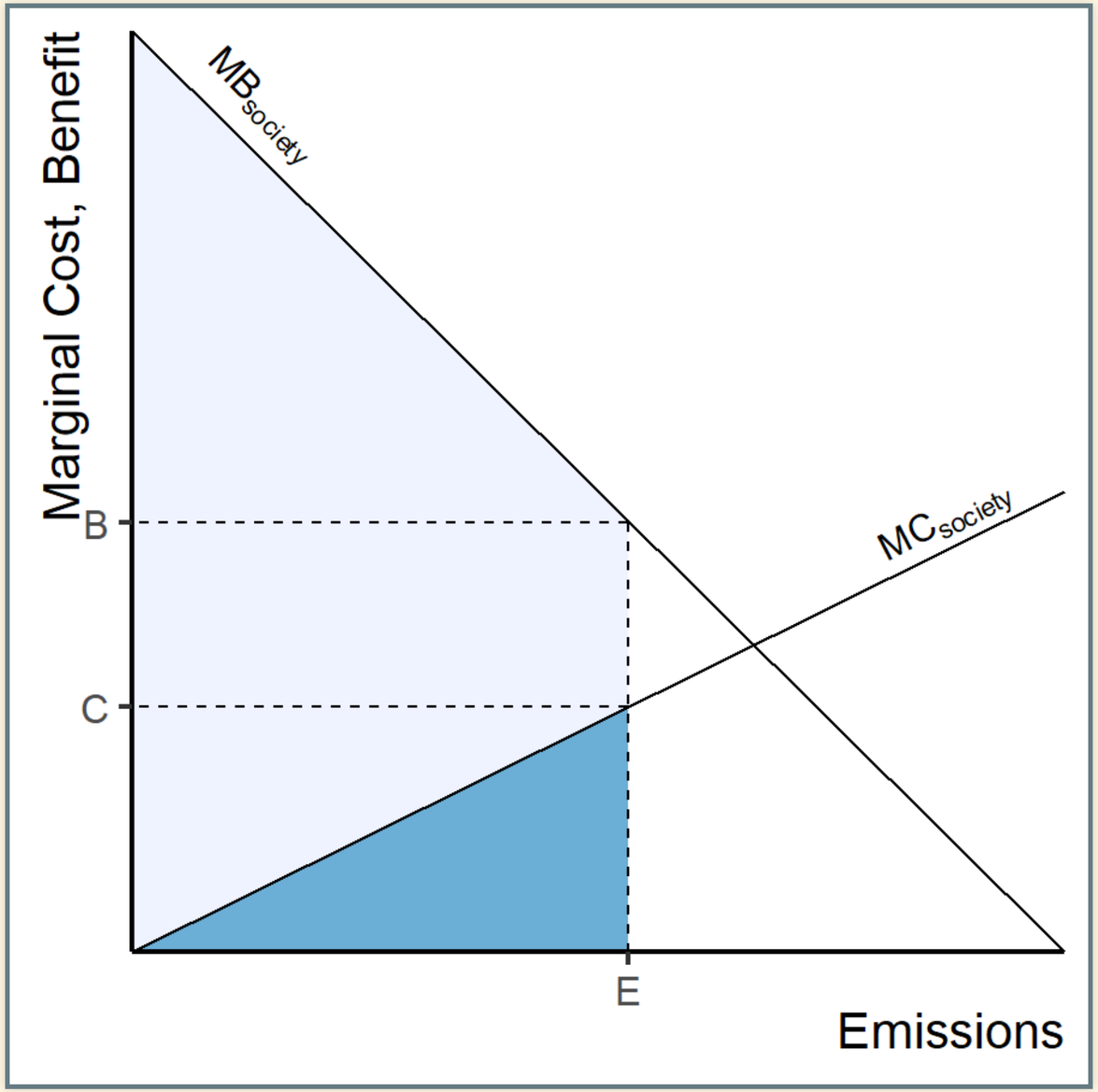
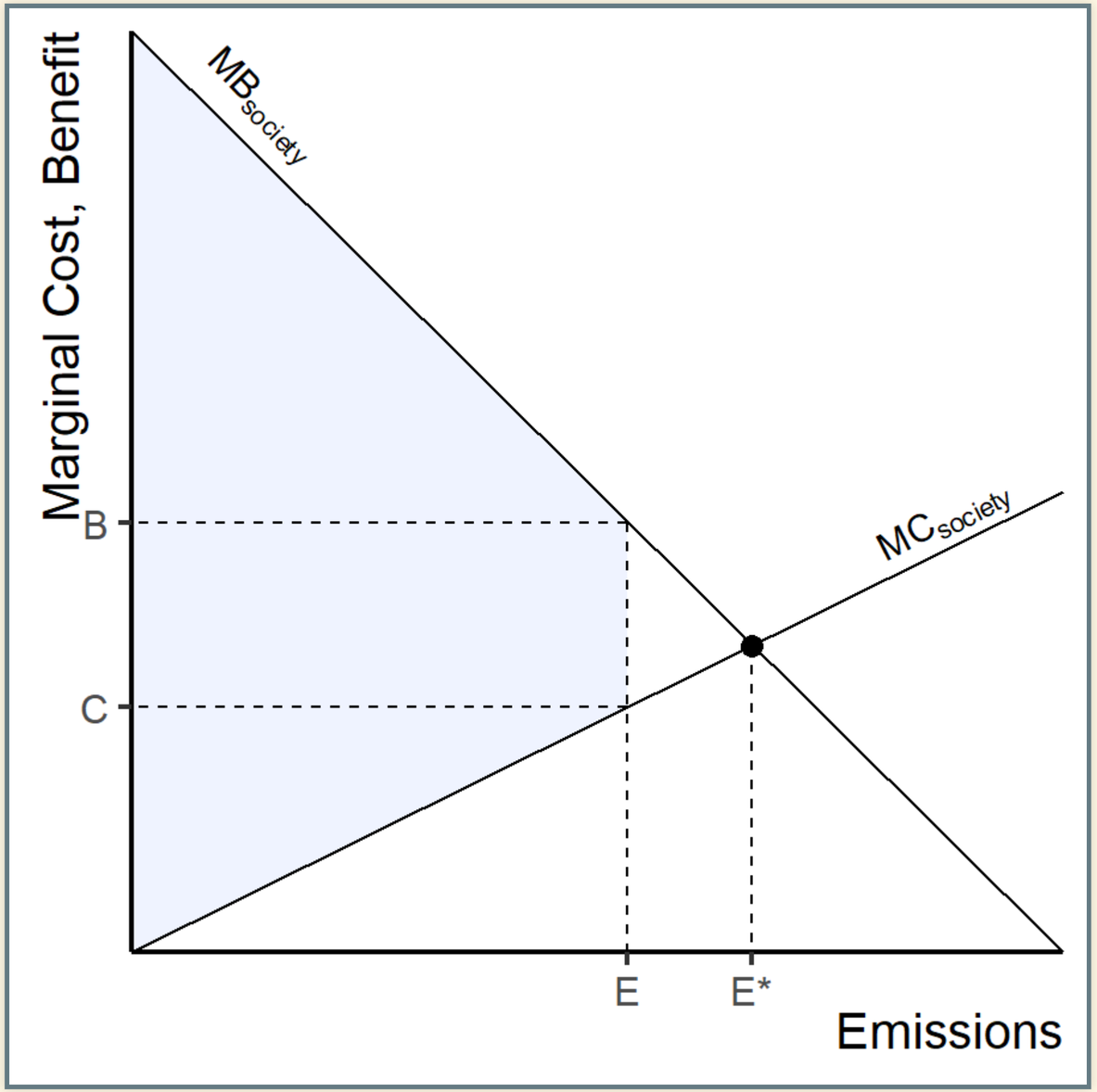
Review of Costs and Benefits

- Total gross benefit = area under MB
- Total gross cost = area under MC
- **Total net benefit** = gross benefit – gross cost
  - Light gray trapezoid

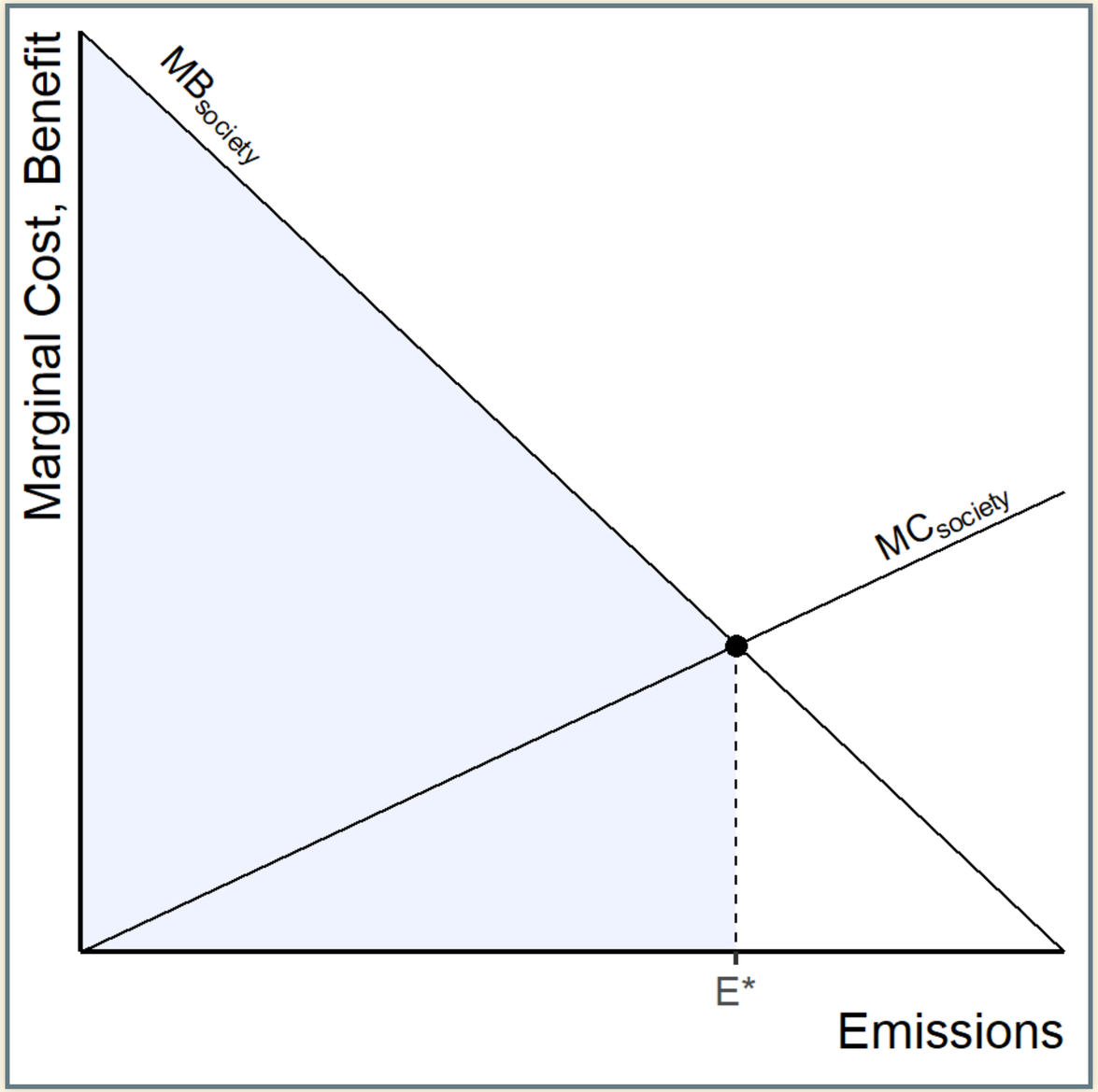


Total Net Benefit



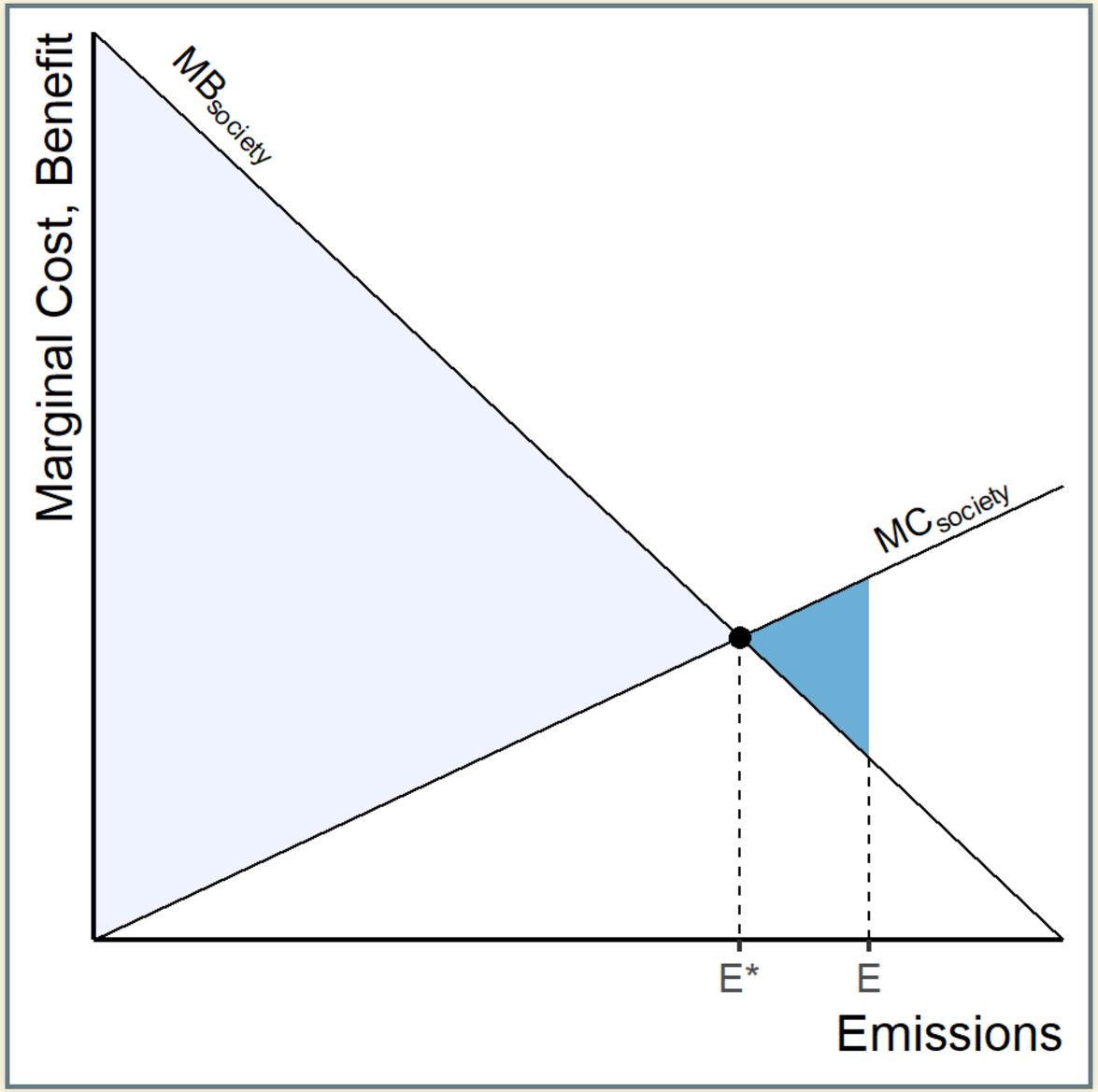
Optimum Emissions

- Optimum emissions = E^*
- EPA regulations allow E^* emissions
- Total net benefits are maximized.



Deadweight Losses

- Optimum emissions = E*
- EPA regulations allow E’ emissions
- Deadweight Loss (dark blue triangle) = difference between **actual net benefit** and **optimum net benefit**



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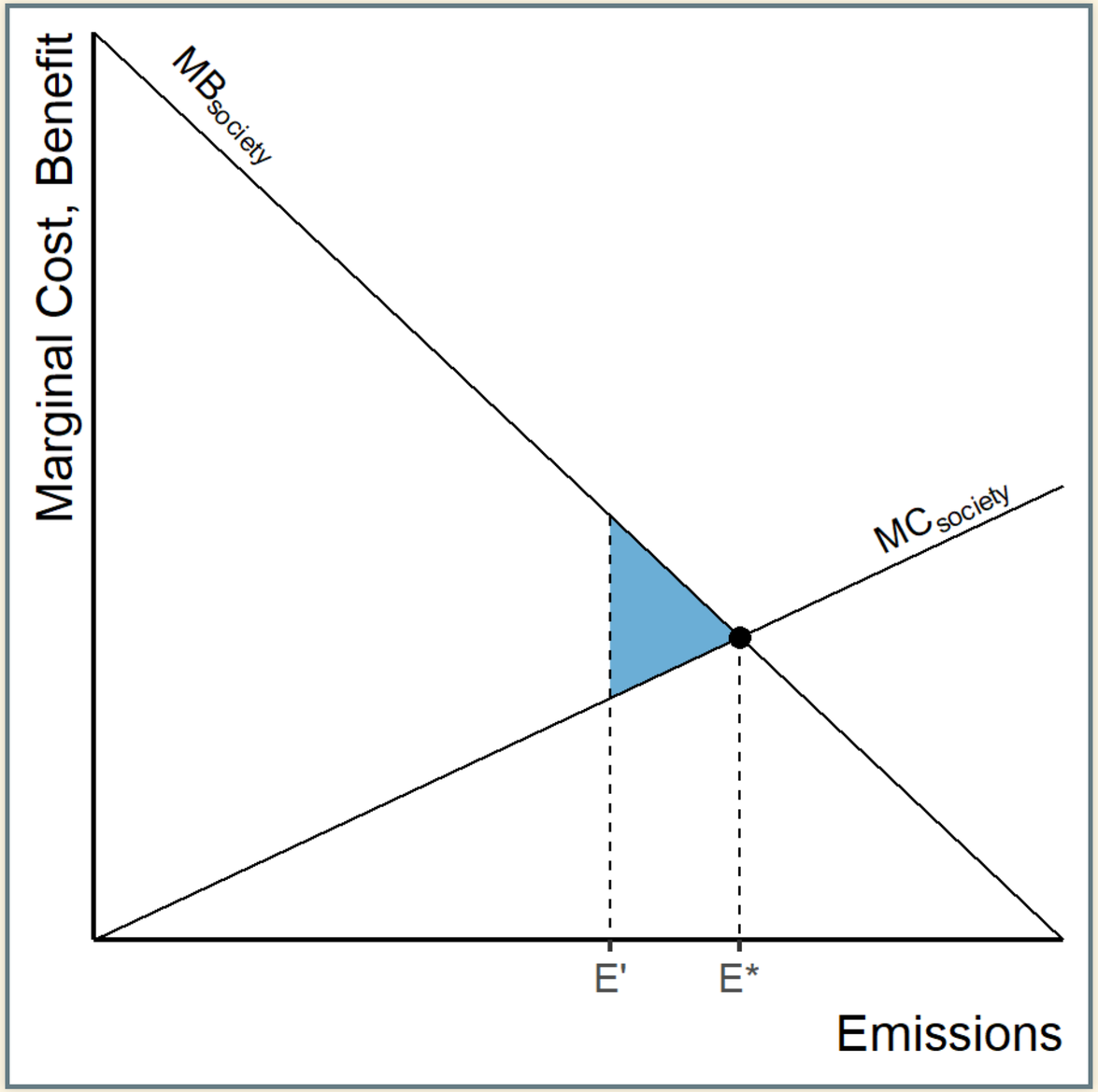


Regulation

Regulation

- **Command and Control**
- **Market-Based Regulation**
  - Put a price on externalities
  - Let the market decide best balance between costs and benefits of pollution
  - *Pigovian tax*:
    - Tax equal to social cost
      - Directly compensate people hurt by pollution
      - Or rebate other taxes: indirect compensation
      - Or invest in socially beneficial projects
        - Clean energy
        - Infrastructure to adapt to climate change
        - Compensate out-of-work coal miners

Nordhaus on Pigovian Taxes

- Taxes on something makes people do less of it
- We want people to work, don’t want them to pollute
- But we tax working and don’t tax polluting
- Revenue-neutral carbon tax:
  - Raise tax on CO_2, cut payroll taxes

Details

- People don’t like paying taxes
- *Invisible taxes*
  - Charge tax when fossil fuels are extracted from ground or imported
  - Fossil fuel producer pays tax, passes cost on to consumers
- Taxes → higher prices → less consumption
- Higher fuel prices:
  - Incentive to buy energy-efficient products
  - Incentive to invent, produce, market efficient products
  - Clean energy becomes more competitive

Simplicity of Carbon Prices

- **Command and Control**:
  - Government has to assess emissions & costs for all kinds of technology
- **Green consumers**:
  - To reduce carbon footprint, research and calculate emissions embedded in products & services
- **Pricing carbon**:
  - Simple calculation: tax carbon content of fuels
  - Consumers receive simple price signal:
    - Shop for lowest price to reduce carbon footprint

Difficulties

- Setting the correct tax rate is hard
  - Social cost of carbon is uncertain
  - Social cost depends on total emissions now & in the future
    - Set tax to marginal cost based on total emissions to date
    - Tax rises over time

Difficulties

- People are not always rational consumers
  - Both as individuals and as organizations
- Often don’t notice small changes in price
- Often don’t recognize opportunities to save through efficiency & conservation
- Importance of calling people’s attention to places they could cut emissions and save money

Difficulties

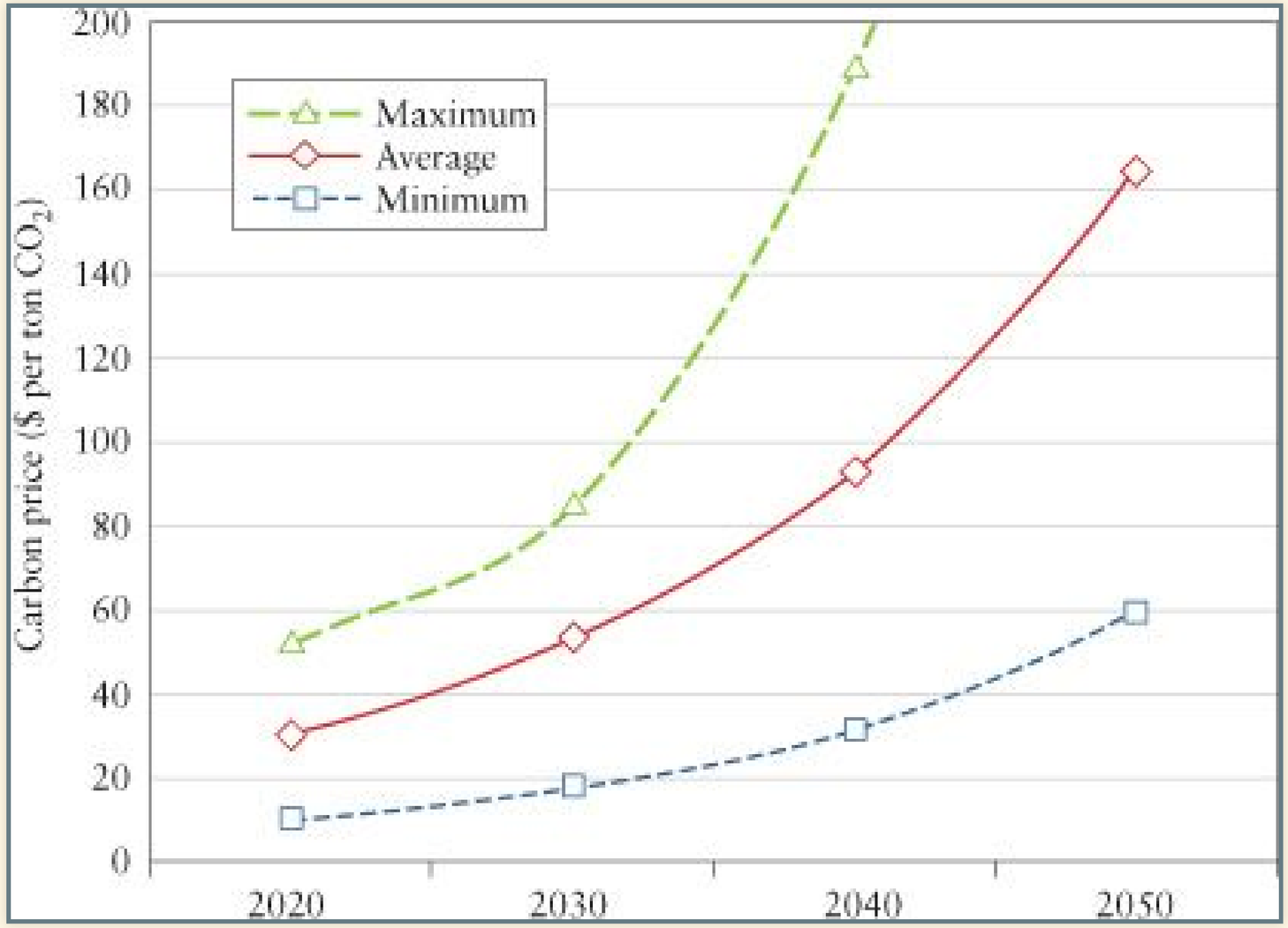
- *Offshoring*
  - If US sets carbon tax, India does not, companies will shift production from US to India
  - Big problem unless carbon tax is applied to all countries

Difficulties

- Lack of control:
  - Actual emissions depend on both *price* **and** *consumer demand*
    - If regulators underestimate demand, emissions and warming will be greater than goal
    - But if social cost is correct, this may mean benefits of energy consumption exceed damage from warming

Carbon Taxes

Example tax calculations



Tax necessary to stabilize at 2.5°C warming

Impact of $25/ton tax

Item	Price increase
Coal	134.0%
Electricity	31.0%
Natural gas	30.0%
Gasoline & petroleum products	11.0%

Impact of $25/ton tax on Household Spending

Item	Tons CO_2	Cost of tax	Spending increase
Annual electricity for one home	9.34	$230.00	19.00%
Economy-class international flight	4.68	$120.00	8.00%
Annual phone & internet	0.01	$0.36	0.04%
Annual total consumption for one household	30.00	$740.00	0.90%

Impact of $25/ton tax on National Economy

Year	Tax rate ($/ton)	Emissions (billion ton)	Revenue ($ billion)	Revenue (% GDP)
2010	$0	6.30	$0	0.000%
2015	$25	5.90	$147	0.960%
2020	$30	5.50	$168	0.970%
2025	$42	5.40	$225	1.140%
2030	$53	5.20	$277	1.250%

- Tax starts in 2015 at $25 per ton
  - Rise steadily so emissions stabilize at 2000 levels by 2030
  - Carbon tax can be used to reduce deficit or cut other taxes
- However, this tax seems very inadequate to limit warming to 2°C.
  - The longer we wait, the higher the tax must be to achieve a policy goal.

Discuss